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ADDITION OF DURIAN PEEL IN CATTLE RATIONS TO IMPROVE DRY MATTER AND ORGANIC DIGESTIBILITY

Penambahan Kulit Durian pada Ransum Sapi dalam Meningkatkan Kecernaan Bahan Kering dan Organik

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Abstract

The utilization of agricultural and plantation waste serves as an alternative solution to overcome farmers' challenges in providing ruminant feed. With the peel composition reaching 60–70% of the total fruit mass, durian generates a significant amount of waste that can be used as livestock feed. Identifying potential feed sources in terms of quality, quantity, and continuity is essential to ensure the availability of feed for beef cattle. The objective of this study was to determine the digestibility of cattle rations supplemented with durian peel. This study employed a completely randomized design with four treatments and three replications. The treatments consisted of a control ration (100% basal ration without durian peel), basal ration with 10% durian peel, basal ration with 15% durian peel, and basal ration with 20% durian peel. The parameters observed were dry matter digestibility (DMD) and organic matter digestibility (OMD), which were analyzed using an in vitro method. The results indicated that the control treatment differed significantly ($P<0.05$) from the other treatments, and increasing levels of durian peel supplementation led to higher digestibility. The conclusion of this study is that the addition of 20% durian peel to the ration optimizes dry matter and organic matter digestibility in the rumen of cattle. Further in vivo studies are required.

Keywords: Cattle feed, digestibility, in vitro, waste

Abstrak

Penggunaan limbah dari sektor pertanian dan perkebunan menjadi salah satu solusi alternatif dalam mengatasi kendala peternak terkait penyediaan pakan ruminansia. Dengan komposisi kulit mencapai 60–70% dari total massa buah, durian menghasilkan limbah dalam jumlah signifikan yang dapat dimanfaatkan sebagai bahan pakan ternak. Identifikasi sumber pakan

potensial dari segi kualitas, kuantitas maupun kontinuitas penting untuk dilakukan dalam menjamin ketersediaan pakan untuk ternak sapi potong. Tujuan penelitian adalah untuk mengetahui nilai kecernaan ransum sapi dengan tambahan kulit durian. Penelitian ini menggunakan rancangan acak lengkap dengan 4 perlakuan dan 3 ulangan. Perlakuan pada penelitian ini adalah control berupa ransum basal 100% tanpa kulit durian; ransum basal dengan 10% kulit durian; ransum basal dengan 15% kulit durian dan ransum basal dengan 20% kulit durian. Parameter yang diamati adalah kecernaan bahan kering (KcBk) dan kecernaan bahan organik (KcBo) yang dianalisis dengan menggunakan metode *in vitro*. Hasil penelitian menunjukkan bahwa perlakuan kontrol berbeda nyata ($P<0,05$) dengan perlakuan lainnya, semakin besar pemberian kulit durian maka semakin tinggi pula kecernaannya. Kesimpulan pada penelitian ini adalah penambahan kulit durian sebesar 20% dalam ransum mampu mengoptimalkan kecernaan bahan kering dan organik pada rumen sapi. Disarankan untuk melakukan penelitian lanjutan secara *in vivo*.

Kata kunci: *In vitro*, kecernaan, limbah, pakan sapi.

INTRODUCTION

Indonesia is required to increase domestic red meat production by at least 30% from the current level (60%) to achieve self-sufficiency in beef by 2026 (Syamsi et al., 2025). Of course, self-sufficiency is aimed at meeting national food needs, especially beef. According to the Central Statistics Agency (BPS, 2024), the population of beef cattle in Indonesia in 2024 is 11,749,780, an increase of 1.27% from 2023. This is directly proportional to beef production in 2024, which reached 496.25 tons, an increase of 3.93% from the previous year. The increase in Indonesia's population has not been able to meet the needs of the Indonesian people. Therefore, efforts are needed to increase cattle productivity to meet the animal protein needs of Indonesians. Beef cattle productivity in Indonesia is still low; therefore, strategies are needed to accelerate beef cattle farming through effective and efficient breeding and fattening systems (Rusdiana and Praharani, 2018).

Efforts to increase beef cattle production are influenced by several factors, including feed, breed, age, initial body weight, and sex. Optimal nutrition, accompanied by good management strategies, can increase the productivity of Bali cattle (Heryanto et al., 2016). The feed for beef cattle must be adjusted to availability, sustainable quality, and adequate quantity. Feed contributes 60-80% of production costs and is a determining factor in production levels and profits obtained by farmers (Widarti et al., 2015). Cattle feed sources can be provided in the form of forage and concentrates, and most importantly, the feed must meet the requirements for protein, carbohydrates, fats, vitamins, and minerals (Wahyunidan and Amin, 2020).

The obstacles faced by farmers in Indonesia, in general, in providing forage, are limited land and sustainable, nutritious feed. The use of waste from agriculture and plantations is one alternative that can address farmers' problems in meeting ruminant feed requirements. In addition, local feed can be easily obtained at an affordable price. According to Purba et al. (2017), waste-derived feed is of poor quality for use as livestock feed owing to its high crude fiber content.

Durian skin is a type of waste that can be processed into animal feed. According to Agustina et al. (2021), durian peel contains nutrients in the form of crude protein 4.73%, crude fat 0.90%, crude fiber 41.24%, ash 8.31%, dry matter 91.11%, and Nitrogen-Free Extract (NFE) 44.82%. Based on the BPS (2024), durian production in Indonesia has reached 1,852,045 tons, with South Sulawesi producing 88,969 tons. According to Agustina et al. (2021), durian peel accounts for 60-70% of the entire durian, resulting in a large amount of waste. This means that durian peel waste in South Sulawesi will reach 53, 381–62, 278 tons in 2024. This potential

adds to the opportunity for durian peel to be used as cattle feed. Identifying potential feed sources in terms of quality, quantity, and continuity is important to ensure the availability of feed for beef cattle. This study aimed to determine the digestibility value of rations with added durian peel.

RESEARCH METHODS

Animal Ethics Compliance

This study exclusively used in vitro methods to examine the digestibility of cattle feed, so no live animals were involved.

Study Object

Durian peel was chopped and fermented with Effective Microorganisms 4 (EM4) for 3 weeks before being mixed into the basal ration. The ration formulation was carried out by arranging various combinations of feed ingredients using the “trial and error” method in Microsoft Excel 2021.

Study Design

This study was designed based on a completely randomized design (CRD) with four treatments and three replicates, resulting in 12 experimental units. The treatments were a control treatment consisting of a basal ration without added durian peel (T0), a basal ration with 10% added durian peel (T1), a basal ration with 15% added durian peel (T2), and a basal ration with 20% added durian peel (T3). The ratio formulations are listed in Table 1.

Study Variables

The variables observed in this study were dry matter digestibility (DMD) and organic matter digestibility (OMD), which were tested in vitro using the method of Tilley and Terry (1963). Digestibility was calculated using the following formula:

$$\text{DMD} = \frac{\text{DM sample} - \text{DM residue} - \text{DM blank}}{\text{DM sample}} \times 100\%$$
$$\text{OMD} = \frac{\text{OM sample} - \text{OM residue} - \text{OM blank}}{\text{OM sample}} \times 100\%$$

Description:

OM : Organic matter (g)
DM : Dry matter (g)
DMD : Dry matter digestibility (%)
OMD : Organic matter digestibility (%)
DM residue : (weight of crucible, filter paper, and residue (g) – weight of crucible and filter paper (g))
DM blank : (weight of crucible, filter paper, and residue (g) – weight of crucible and filter paper (g))
OM residue : DM residue (g) – ash weight (g)
OM blank : DM residue (g) – ash weight (g)

Data Collection Method

Durian peel was chopped into small pieces and fermented with EM4, molasses, and bran for 3 weeks before being mixed into the basal ration. The formulation was calculated based on price efficiency and nutrient adequacy for beef cattle, namely 11% protein and 62% Total Digestible Nutrients (TDN). After that, the ration was tested with an In Vitro test to determine dry matter digestibility (DDM) and organic matter digestibility (ODM).

Data analysis

This study used a completely randomized design. Data analysis was performed using analysis of variance (ANOVA), and if there was a significant effect of the treatment, it was further tested using Duncan's multiple range test at the 5% level.

RESULTS AND DISCUSSION

Results

Dry Matter Digestibility (DDM)

The digestibility of fermented durian peel dry matter is shown in Table 2. The results of the analysis of variance showed that fermented durian peel had a significant effect ($P<0.05$) on the average in vitro digestibility of dry matter. The results ranged from 68.90% to 73.59%. Duncan's test results show that the control treatment differs from the other treatments. The highest digestibility value was found in the treatment with 20% durian peel (T3), and the lowest was in the control treatment (T0).

Organic Matter Digestibility (ODM)

The digestibility of fermented durian peel organic matter is shown in Table 2. The ANOVA results showed that durian peel fermentation had a significant effect ($P<0.05$) on the average in vitro digestibility of organic matter. This indicates that fermented durian peel increases the digestibility of organic matter. The results ranged from 65.35% to 69.37%. Duncan's test results showed that the control treatment was different from the other treatments. The highest digestibility value was found in the treatment with 20% durian peel (T3), and the lowest was in the control treatment (T0).

Discussion

Increased durian peel concentration in cattle feed was positively correlated with dry matter and organic matter digestibility. These findings are consistent with the research by Khota et al. (2023), which shows that durian peel silage with additives, such as molasses, lactic acid bacteria, and cellulase, improves fermentation quality and in vitro digestibility. The chemical composition of Durian peel is rich in fermentable fibers, such as cellulose and hemicellulose. When added in the correct amount, these fibers can stimulate rumen microbial activity, especially cellulolytic bacteria, which play a role in breaking down complex components into simple compounds that are easily absorbed by livestock. Durian peel contains high moisture content (78-83%) and water-soluble carbohydrates (4.20-4.61%) on a dry matter basis (Khota et al., 2023).

Dry Matter Digestibility (DDM)

Digestibility is closely related to chemical composition, especially crude fiber content. The more crude fiber contained in a feed ingredient, the thicker and more resistant the cell walls, and consequently, the lower the digestibility of the feed ingredient (Yang & Zhao, 2022). Conversely, feed materials with low crude fiber content are generally easier to digest because the cell walls of these materials are thin and easily penetrated by digestive juices. During

fermentation, microbes in probiotics can break down lignin and crude fiber (cellulose and hemicellulose) bonds. Enzymes such as cellulase and hemicellulase play an important role in breaking down the plant matrix. These enzymes are optimized under certain conditions to maximize the release of sugars and other value-added compounds from cellulose and hemicellulose (Manuela del Rosario & Rita, 2022).

High crude fiber content can reduce digestibility, as observed in studies where varying fiber levels in feed affected nutrient utilization in poultry and pigs (Jha et al., 2025). Dry matter digestibility is a key indicator of feed quality, as higher digestibility values are associated with better feed quality (Prabowo & Sukaryani, 2025). Digestibility significantly affects livestock feed quality by increasing nutrient bioavailability (Rosli et al., 2025). Digestibility significantly affects livestock feed quality, because higher digestibility leads to better nutrient absorption and energy availability for livestock (Bargavi et al., 2025).

Organic Matter Digestibility (ODM)

Durian skin also contains bioactive compounds, such as flavonoids and tannins, at low levels, which, if not excessive, can help stimulate the digestive system and improve rumen fermentation efficiency. Flavonoids in durian peel have been identified for their strong antioxidant activity. These compounds can reduce oxidative stress in animals, which is beneficial for overall health and can improve nutrient absorption and metabolism in the rumen (Rabbaniyyah & Suciati, 2023). With increased fermentation, the decomposition of feed materials becomes more optimal, thereby improving the digestibility of organic matter. This explains why the T1–T3 treatments showed an increasing trend in digestibility as the proportion of durian peels increased. Additionally, the coarse fiber texture of durian peel can increase feed retention time in the rumen, allowing more time for microbes to work. The complex structure of lignin and other polysaccharides in plant cell walls can slow the digestion process, allowing more time for microbial action (Tedeschi et al., 2023). Longer retention times allow the fermentation process to proceed more completely, making dry matter that was originally difficult to digest accessible to the cow digestive system. Stabilizing rumen fermentation characteristics is essential for optimal nutrient digestibility. A study on Holstein cattle showed that rumen fermentation parameters, such as acetate and propionate concentrations, require more time to stabilize when the feed shifts, indicating that longer retention times can help achieve stable fermentation conditions (Qiu et al., 2021). This is particularly important for improving the efficiency of feed conversion into energy and nutrients.

The digestibility of organic matter is an important factor that affects the quality of animal feed, as it directly influences nutrient availability and overall animal performance. Improved digestibility contributes to increased nutrient availability, which is important for livestock fattening performance (Huang et al., 2021). Improving the digestibility of organic matter through various treatments can significantly increase the nutritional value of feed ingredients, particularly those derived from agricultural wastes. Santoso et al. (2020) showed that adding cellulase to complete feed silage based on agricultural waste significantly improves the in vitro digestibility of organic matter (OM). Specifically, the addition of cellulase increases the digestibility of dry matter, organic matter, and neutral detergent fiber (NDF), thereby improving the nutritional value of feed ingredients. This increase in digestibility is important for optimizing the use of agricultural waste in livestock feed and ensuring better nutrient availability for livestock production.

The digestibility of animal-derived feed reveals variations that affect the overall nutritional value and efficiency of non-ruminant feed (Silva et al., 2020). Higher digestibility leads to better nutrient utilization and improved growth and health in livestock, which ultimately

contributes to the increased availability of animal protein for human consumption (Suprapto et al., 2020).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the results of this study, the addition of 20% durian peel to cattle feed optimizes the digestibility of dry and organic matter in the rumen, thereby improving feed efficiency and effectiveness.

Recommendations

Fermented durian peel can be applied up to 20% in cattle feed rations. Further in vivo trials should be conducted directly in beef cattle.

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Table

Table 1. Feed formulation composition with various combinations of local feed ingredients

Feed ingredients (%)	T0	T1	T2	T3
Ground corn	29	26	25	23
Corn Tumpi	21	21	21	21
Rice bran	15	15	15	15
Soybean meal	14	14	14	14
Durian peel	0	10	15	20
Peanut hulls	10	7	4	2
Corn cobs	7	3	2	1
Molasses	4	4	4	4
Total (%)	100	100	100	100
Crude protein (%)	11.87	11.94	11.97	11.96
Total Digestible Nutrients (TDN, %)	62.91	62.51	62.84	62.63

Table 2. Average feed digestibility results.

Parameter	Experimental			
	T0	T1	T2	T3
DMD (%)	68.90±0.50 ^b	67.46±0.40 ^a	70.86±0.20 ^c	73.59±0.10 ^d
OMD (%)	65.35±0.05 ^b	62.91±0.50 ^a	66.89±0.20 ^c	69.37±0.07 ^d

Notes: Different superscripts within the same row indicate significant differences ($P < 0.05$).
T0 = Basal ration; T1 = Basal ration + 10% durian peel; T2 = Basal ration + 15% durian peel;
T3 = Basal ration + 20% durian peel. DMD = Dry matter digestibility; OMD = Organic matter digestibility.